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IDENTIFIERS	GATB; *General Aptitude Test Battery

ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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Development of USES Aptitude Test Battery for Chemical and Metallurgical Technology - Technical Institute Training

008.··· and 011.···

U.S. DEPARTMENT OF LABOR
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Washington, D.C. 20210

Technical Report on Development of USES Aptitude Test Battery

For .....

Chemical and Metallurgical Technology-Technical Institute
Training 008.--- and 011.---

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U. S. Employment Service
in Cooperation with
Wisconsin State Employment Service

July 1966

GATB Study #2605

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Chemical and Metallurgical Technology-Technical Institute
Training 008.--- and 011.---

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This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for Chemical and Metallurgical Technology-Technical Institute Training 008.--- and 011.---. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
V - Verbal Aptitude	95
N - Numerical Ability	105
S - Spatial Aptitude	95

RESEARCH SUMMARY

Sample:
55 male Chemical and Metallurgical Technology students at the Milwaukee Institute of Technology, Milwaukee, Wisconsin.

Criterion:
Grade-point averages

Design:
Longitudinal (sample was tested prior to enrollment in training course and criterion data were collected at completion of the course).

Minimum aptitude requirements were determined on the basis of an analysis of a job description and a description of course requirements; statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:
Phi Coefficient = .51 (P/2 less than .0005)

Effectiveness of Norms:
Only 66% of the non-test-selected students used for this study were good students; if the students had been test-selected with the above norms, 82% would have been good students. 34% of the non-test-selected students used for this study were poor students; if the students had been test-selected with the above norms, only 18% would have been poor students. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Students	66%	82%
Poor Students	34%	18%

SAMPLE DESCRIPTION

Size:
N = 55

Occupational Status:
Students

School:
Milwaukee Institute of Technology, Milwaukee, Wisconsin.

School Admission Requirements:
Admission to the technology program is limited to high school graduates or adults, 21 years of age or older, whose eligibility has been determined by the evaluation of previous work experience, education and an entrance examination. Students are required to have taken one year of high school algebra and plane geometry. It is highly desirable for a student to have at least one year of high school science, three years of english and two years of social studies and history.

Principal Activities:
The course of study for the first year is identical. There is specialization during the second year in some courses designed for metallurgy and chemistry. Basically the institute considers both chemical and metallurgical technology as one course of study.

Minimum Experience:
All the students in the sample had at least three semesters or equivalent at the institute.

TABLE 2

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with Criterion (r) for Age and Education

	Mean	SD	Range	r
Age (years)	20.7	3.2	18-38	.100
Education(years)	13.6	.5	13-15	.324*

*Significant at the .05 level

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered during the period February 1962 and 1965.

CRITERION

The criterion consisted of the grade-point average of all subjects except English, Physical Education, Social Science and Photography. (The course of study for Chemical and Metallurgical Technology is basically the same.) Letter grades of A, B, C and D correspond to grade points of 40, 30, 20 and 10, respectively. The range of grade-point averages was 12.5 to 32.4 with a mean of 24.3 and a standard deviation of 5.67.

Criterion Dichotomy:

The criterion was dischotomized into low and high groups by placing 34% of the sample in the low group to correspond with the percentage of students considered unsatisfactory or marginal. Students in the high group were designated as "good students" and those in the low group as "poor students."

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude S which did not have a high correlation with the with the criterion was considered for inclusion in the norms because it was judged to be important for job success and the experimental sample had a relatively high mean score for this aptitude.

TABLE 3

Qualitative Analysis
(Based on the analysis of the course of study, the aptitudes indicated appear to be important for success in this curriculum)

Aptitude	
G - General Learning Ability	Necessary to learn and understand principles taught in the course of study and to apply these principles in the laboratory.
V - Verbal Ability	Necessary to understand written technical information and to present information orally and in writing.
N - Numerical Aptitude	Necessary to make mathematical calculations to solve problems.
S - Spatial Aptitude	Necessary to interpret diagrams and to comprehend molecular structure of metals.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	117.3	12.9	90-147	.373**
V - Verbal Ability	108.0	13.7	78-143	.373**
N - Numerical Aptitude	115.1	12.0	83-143	.271*
S - Spatial Aptitude	119.9	14.8	88-153	.205
P - Form Perception	113.0	14.5	67-140	.064
Q - Clerical Perception	109.6	11.4	87-138	.035
K - Motor Coordination	108.6	14.6	70-144	.068
F - Finger Dexterity	107.5	17.4	67-158	-.151
M - Manual Dexterity	117.3	23.0	56-182	-.105

*Significant at the .05 level
**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X	X	X	X					
Irrelevant									
Relatively High Mean	X			X					X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X	X	X						
Aptitudes to be Considered for Trial Norms	G	V	N	S					

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G, V, N and S at trial cutting scores were able to differentiate between the 66% of the sample considered good workers and the 34% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about 1/3 of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about 1/3 of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about 1/3 of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of V-95, N-105 and S-95 provide the highest degree of differentiation. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .51 (statistically significant at the .0005 level).

TABLE 6

Predictive Validity of Test Norms

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Students	5	31	36
Poor Students	12	7	19
Total	17	38	55

Phi Coefficient (Ø) = .51
Significance Level = $P/2 < .0005$

Chi Square (X^2) = 14.135

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

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FACT SHEET

Course of Study

Chemical and Metallurgical Technology-Technical Institute Training 008.--- and 011.---

First Semester

Field	Subject	Credits
Chem-Met. Technology	Principles of Metallurgy	3
Mechanical Technology	Basic Technical Drafting	2
*English	Communication Skills	3
Mathematics	Technical Mathematics	4
Natural Science	Chemistry	4
*Physical Education	Physical Education	1
		17

Second Semester

Field	Subject	Credits
Chem-Met. Technology	Fundamentals of Inspection and Testing of Materials	3
*English	Communication Skills	3
Mathematics	Technical Mathematics	4
Natural Science	Chemistry	4
Natural Science	Technical Science	4
		18

Chemical Major

Third Semester

Field	Subject	Credits
Chem-Met. Technology	Technical Methods of Analysis	3
Electrical Technology	Fundamentals of Electricity	1
Natural Science	Introduction to Organic Chemistry	3
Natural Science	Quantitative Chemical Analysis	4
*Social Science	Psychology of Human Relations	3
*Social Science	American Institutions	3
		17

Fourth Semester

Chem-Met. Technology	Chemical Processes	4
Chem-Met. Technology	Instrumental Methods of Analysis	4
Natural Science	Quantitative Chemical Analysis	4
*Social Science	Business and Industrial Relations	3
		15

Metallurgical Major

Third Semester

Chem-Met. Technology	Principles of Metallography	3
Chem-Met. Technology	Fundamentals of Heat Treatment of Metals	2
Electrical Technology	Fundamentals of Electricity	1
*Photography	Introduction to Photography	2
Mechanical Technology	Mechanics of Materials	3
Natural Science	Quantitative Analysis	4
*Social Science	American Institutions	3
		18

Fourth Semester

Chem-Met. Technology	Instrumental Method of Analysis	4
Chem-Met. Technology	Advanced Metallography	2
Chem-Met. Technology	Advanced Heat Treatment of Metals	2
Chem-Met. Technology	Fundamentals of Industrials X-Ray	1
*Social Science	Psychology of Human Relations	3
*Social Science	Business and Industrial Relations	3
		15

*Not included in criterion data

(The content of the course on which this study was conducted should be studied carefully and compared with the course content of S-324 and S-325 before a decision is made on the appropriateness of S-378.)

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July 1966

FACT SHEET

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Field	Subject	Credits
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Field	Subject	Credits
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*English	Communication Skills	3
Mathematics	Technical Mathematics	4
Natural Science	Chemistry	4
Natural Science	Technical Science	4
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Chemical Major

Third Semester

Field	Subject	Credits
Chem-Met. Technology	Technical Methods of Analysis	3
Electrical Technology	Fundamentals of Electricity	1
Natural Science	Introduction to Organic Chemistry	3
Natural Science	Quantitative Chemical Analysis	4
*Social Science	Psychology of Human Relations	3
*Social Science	American Institutions	3
		17

Fourth Semester

Chem-Met. Technology	Chemical Processes	4
Chem-Met. Technology	Instrumental Methods of Analysis	4
Natural Science	Quantitative Chemical Analysis	4
*Social Science	Business and Industrial Relations	3
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Metallurgical Major

Third Semester

Chem-Met. Technology	Principles of Metallography	3
Chem-Met. Technology	Fundamentals of Heat Treatment of Metals	2
Electrical Technology	Fundamentals of Electricity	1
*Photography	Introduction to Photography	2
Mechanical Technology	Mechanics of Materials	3
Natural Science	Quantitative Analysis	4
*Social Science	American Institutions	3
		18

Fourth Semester

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Chem-Met. Technology	Advanced Metallography	2
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